

## II.4-LOOKUP3 3 VARIABLE TABLE LOOKUP OPERATION

### Introduction

The 3-variable lookup operation linearly interpolates for a dependent result given two independent arguments and a family of curves relating the two independent arguments to the dependent argument.

This Operation is used at the Northwest River Forecast Center (NWRFC) to compute backwater effects on an upstream location. Examples of applications include river estuaries affected by tidal fluctuations, river reaches upstream from a junction with a major tributary and the upstream reaches of a reservoir or a lake whose outflow is affected by the elevation of another lake just downstream. This method utilizes a 3-variable relationship between upstream flow (Q1), downstream elevation (E2) or flow (Q2) and elevation from the upstream location (E1):

$$E1 = f (Q1, E2)$$

or

$$E1 = f (Q1, Q2)$$

An example of such relationships is illustrated in Figure 1. The program treats the flow of the upstream station at any period as dependent upon the water surface elevation (or flow) of the downstream control station and also on the water surface elevation of the upstream station.

### Example

An operational example in use at the NWRFC involves computing the backwater effects on the stage at the St. Joe River at St. Maries, Idaho from the lake elevation of Coeur d'Alene Lake. The 3-variable relationship is as shown in Figure 2. In this case, what is known is the flow at the St. Maries gage from the routed flow from the St. Joe River at Calder and the lake elevation of Coeur d'Alene Lake. Entering the plot with a Coeur d'Alene elevation of 2125.0 FT and tracing up to the Z curve for a routed Calder flow of 10000 CFS, the backwater affected stage of St. Maries is then approximated at 30 FT.

### References

SSARR Model: Streamflow Synthesis and Reservoir Regulation, U.S. Army Corps of Engineers, North Pacific Division, January 1991.

Figure 1. Example of Discharge-Elevation Relationships Handled by the SSARR Backwater Mode

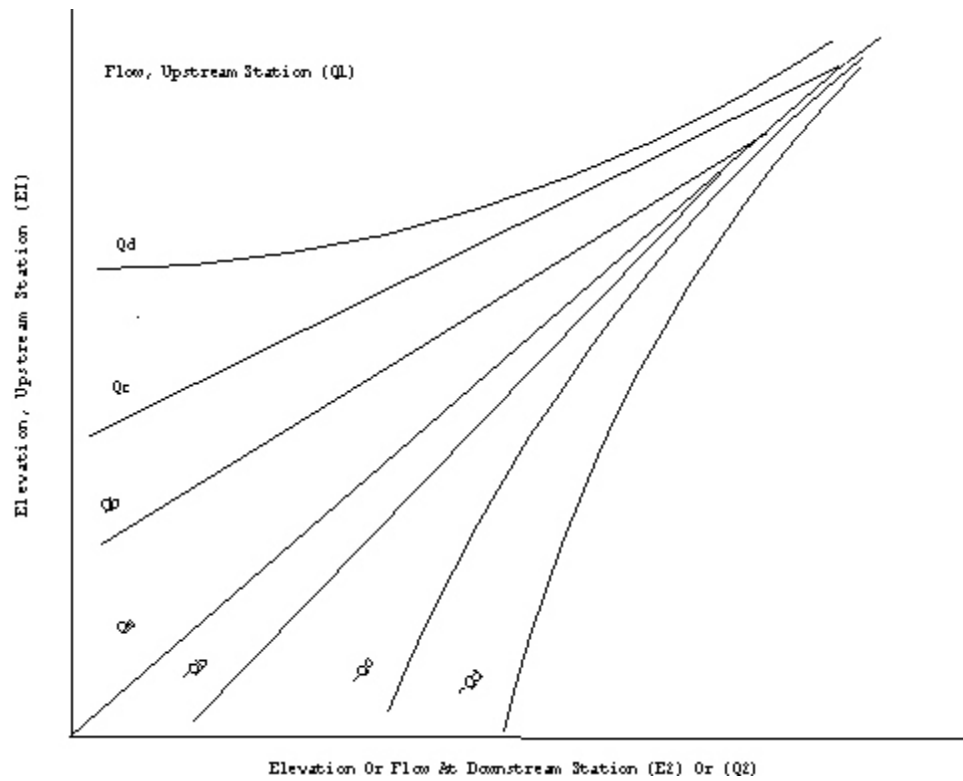


Figure 2. 3-Variable Relationship

